Report to Council

Date: March 1, 2021

To: Council

From: City Manager

Subject: Green Infrastructure Opportunities

Department: Policy & Planning

Recommendation:

THAT Council, receives, for information, the report from the Policy and Planning department, dated March 1, 2021, outlining opportunities for green infrastructure in Kelowna;

AND THAT Council directs staff to pursue the recommended approach outlined in the report from the Policy and Planning department, dated March 1, 2021, to implement green infrastructure in the City's right of way.

Purpose:
To inform Council on options available to increase green infrastructure (GI) in Kelowna's public road rights of way (ROWs).

Background:
A changing climate has major consequences for local governments who are on the front lines of storms, flooding and wildfires; responsible for infrastructure; provide first responder services; and educate and prepare residents.[1] The findings of the recent "*Climate Projections for the Okanagan Region*" models the changes that the Okanagan climate could experience over the coming decades[2] which will influence Kelowna's future infrastructural needs. Significant changes are projected with hotter and drier summers, warmer winters, increased precipitation in all seasons except summer, and a shifting of the seasons.

The use of green infrastructure (GI), defined as "*enhanced ecological and engineered assets designed to mimic and maintain connectivity with natural systems"*, is one option the City can employ that will help deliver on Council's priority to *prepare for and be resilient to the potential changes in climate*. Policy in

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[1] Don Lidstone, QC and Ian Moore, September 25, 2019. "Declaring a Climate Emergency – Legal Issues" for Planning Institute of BC Climate Emergency Webinar.

[2] Regional District North Okanagan, Regional District of Central Okanagan, Okanagan-Similkameen, Pinna Sustainability. (2020). *Climate Projections for the Okanagan Region.* Retrieved from: https://www.regionaldistrict.com/media/279459/OK_Climate_Projections_Report_Final.pdf

the 2040 Draft Official Community Plan provides direction for the use of green infrastructure to help reduce the vulnerabilities of natural and human systems to new climate realities and capitalize on new opportunities. Like most climate initiatives, it is not a silver bullet solution, but is an effective means to address climate change resiliency and adaptability, while reducing greenhouse gas (GHG) emissions.

As Kelowna's climate continues to change, GI can help address the anticipated increased storm events, heat waves and flooding. GI options range from onsite assets like green roofs and cisterns, to offsite (City-owned) assets like bioretention and permeable pavements. These integrated GI techniques aim to deviate from natural processes as little as possible, delivering multiple benefits while building resiliency to the pressures of climate change as illustrated (see Figure 1). Ultimately, GI is one tool that helps return developed areas to a pre-developed ecological state.

Figure 1: Benefits of green infrastructure

With a grant from the Pacific Institute for Climate Solutions (PICS), a Climate Adaptation Intern was hired for a four-month period. This intern investigated high level options for the City to pursue green infrastructure, then refined the research to look specifically at options for utilizing green infrastructure in public road rights of ways (ROWs) as illustrated in Figure 2.

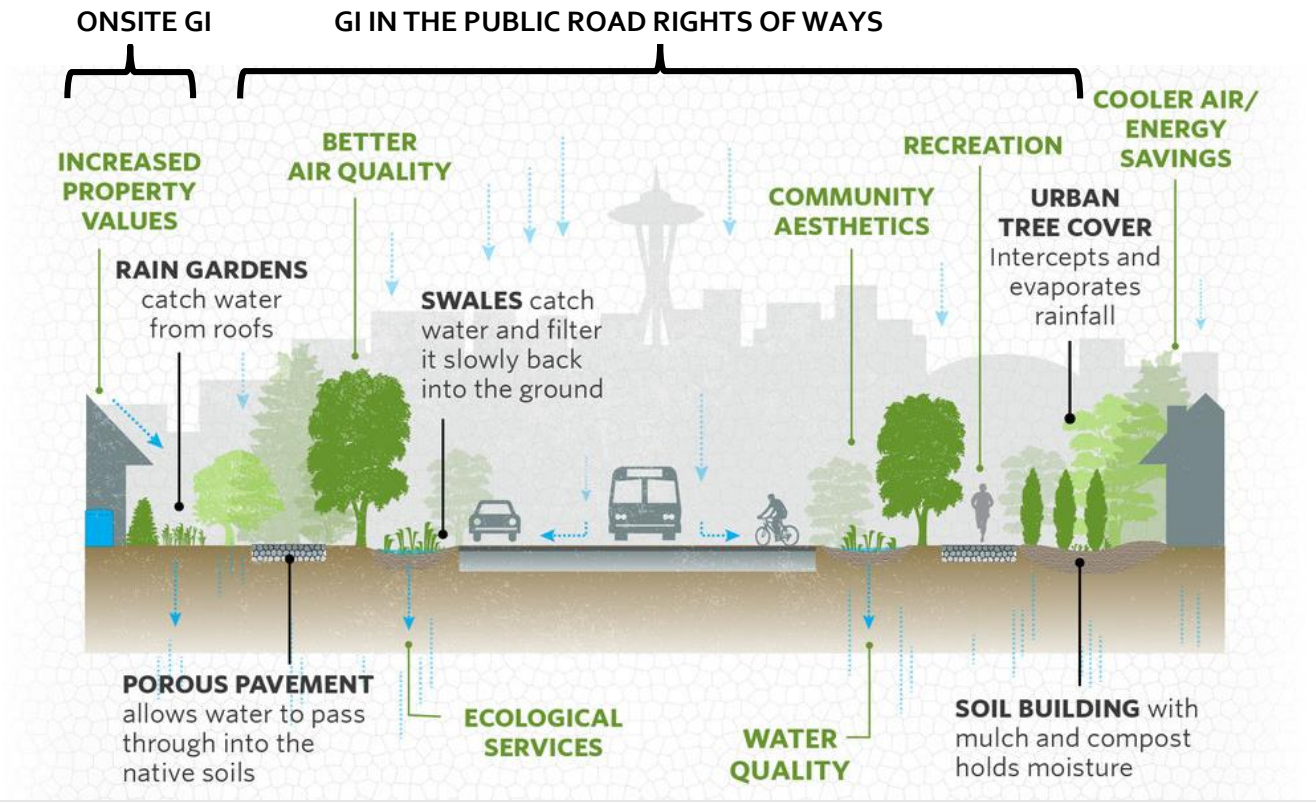

Figure 2: Green infrastructure in the ROW.
Source: https://www.washingtonnature.org/cities/stormwater/green-infrastructure-infographic

Discussion:

The City maintains approximately 525 km of paved ROW. For context, the City would have to address approximately 31,500 liters of stormwater runoff for a typical 3mm storm event over this network, plus any onsite stormwater that runs into the ROW. Despite being able to address stormwater events such as these, while providing numerous other benefits, GI is often perceived as an expensive "add-on". As no framework currently exists to identify GI opportunities, it places these considerations as an afterthought in the ROW decision-making, design, and implementation processes.

Figure 3 illustrates the types of GI assets that can be implemented in the ROW, according to their classification as either enhanced or engineered. GI in the ROW is the most cost-effective option at the time of initial development. It can, however, be implemented during reconstruction, repaving, urbanization, or adjacent onsite development projects. GI is not suitable in all locations, and site specific conditions, such as those listed below, should be met to avoid risks or challenges:

- *No pre-existing or failing stormwater infrastructure exists*. It is cost ineffective to remove functioning infrastructure;
- *Relatively flat site*. Steep hillsides pose stormwater velocity and hillside erosion risk;

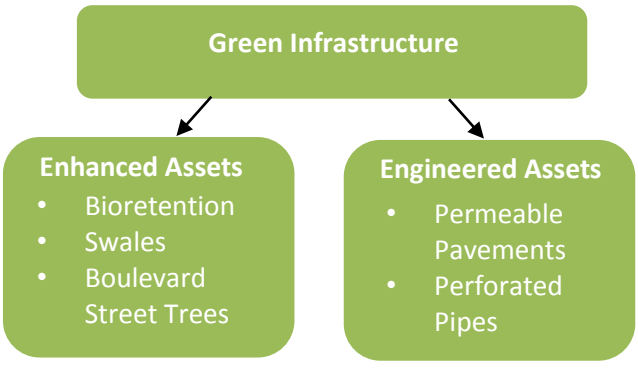

Figure 3: GI Assets that can be implemented in the ROW
Source: Municipal Natural Assets Initiative. (2017). Defining and Scoping Municipal Natural Assets.

- *Soils with appropriate permeability and saturation*. Drainage is critical to successful GI implementation; or
- *Not in close proximity to riparian areas*: A higher water table adjacent to riparian areas may impact GI effectiveness.

The City already employs several forms of GI. Gravel soak-aways (the unpaved road areas between pavement and property line) were common design practice in the past and remain an effective method of disposing runoff from minor storms to ground while still allowing for parking and winter snow removal. Soak-aways are maintained by City operations, and their effectiveness is based on how much fines are mixed with coarse gravels from normal road sweeping and snow clearing operations. Further examples of other GI assets the City has piloted include bioretention[3] at Lakeshore and Cook, Silva cells[4] on Lawrence avenue, and permeable pavers[5] at Parkinson Recreation Centre and City Park. These examples continue to function as designed, but there has yet to be a neighborhood scale implementation of GI in the ROW that acts as a larger scale substitute for conventional infrastructure. A lack of monitoring of GI assets has made it difficult to evaluate their performance and benefits.

Economics of Green Infrastructure

A 2011 report analyzing nearly 500 GI projects across the US and Canada found that in 75 per cent of the cases GI either reduced or did not influence the cost of a project.[6] Savings can be realized in all three phases of a project: construction, maintenance, and refurbishment/demolition.

1. ***Construction***. Savings are realized by a reduced need for conventional infrastructure. For example, the City of Seattle has reported savings of 10-20% for GI ROW development compared to conventional ROW development, citing reduced needs for curbs, gutters, catch basins, and asphalt.[7] While the City of Kelowna does not construct many ROWs, communicating these savings could act as an effective incentive to increase the uptake of GI amongst developers.
2. ***Maintenance***. Maintenance costs present an obstacle to GI implementation as it is often more expensive to maintain than conventional infrastructure. While true, this ignores the reality that GI assets like bioretention facilities, permeable pavement and grassed swales can act as an effective substitute to large-scale GI assets like stormwater detention ponds, and over the long term, their maintenance costs can be less expensive. Some municipalities have found that residents become stewards of GI, seeing its worth to their property value, well-being, and

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[3] Bioretention refers to three types: bioretention curb bump-outs, boulevard bioretention, and roundabout bioretention. They all use natural infiltration, evapotranspiration, and infiltration properties of soil and vegetation to collect and treat stormwater runoff.

[4] The Silva Cell is a modular suspended pavement system that uses soil volumes to support large tree growth and provide powerful on-site stormwater management through absorption, evapotranspiration, and interception.

[5] Permeable pavement refers to three types of surfaces: porous asphalt, pervious concrete, permeable interlocking pavers. All types use porous spacing to reduce the amount of impermeable surface on paved areas.

[6] American Society of Landscape Architects. (2011, September 26). *ASLA Releases More than 475 Green Infrastructure Case Studies*. Retrieved from: https://dirt.asla.org/2011/09/26/asla-releases-more-than-475-stormwater-management-case-studies/

[7] United States Environmental Protection Agency. (2010). *Green infrastructure case studies: municipal policies for managing stormwater with green infrastructure.* (EPA-841-F-10-004). Retrieved from: https://nepis.epa.gov/Exe/ZyPDF.cgi/P100FTEM.PDF?Dockey=P100FTEM.PDF

community,[8] however, in one Kelowna example, it was found that as homeownership changes, new residents do not always want the responsibility.

3. ***Rehabilitation and demolition.*** Research shows that although conventional infrastructure refurbishment is required less frequently than GI, its substantially higher costs associated with roadway excavation will drive prices up.[9] Further, GI can offer a more cost-effective means to balance various City objectives, while concurrently enjoying numerous ancillary benefits.

To understand the potential implementation and cost savings in a local context, staff performed a case study on the impacts on the servicing requirements of a proposed rezoning of 70 lots in the City's Health District to a RU7 classification. In response to the increase in impervious surface and associated stormwater runoff, Utility Planning completed a high-level neighbourhood analysis of proposed GI solutions that could infiltrate the additional stormwater runoff including bioretention curb bump-outs, grass swales, and bioswales. Staff further conducted a parallel life cycle analysis to help guide decisions around the costs and benefits of two alternatives. Figure 4 demonstrates the key findings, summarizing the benefits and cost savings that GI development could have compared to a hypothetical conventional development.

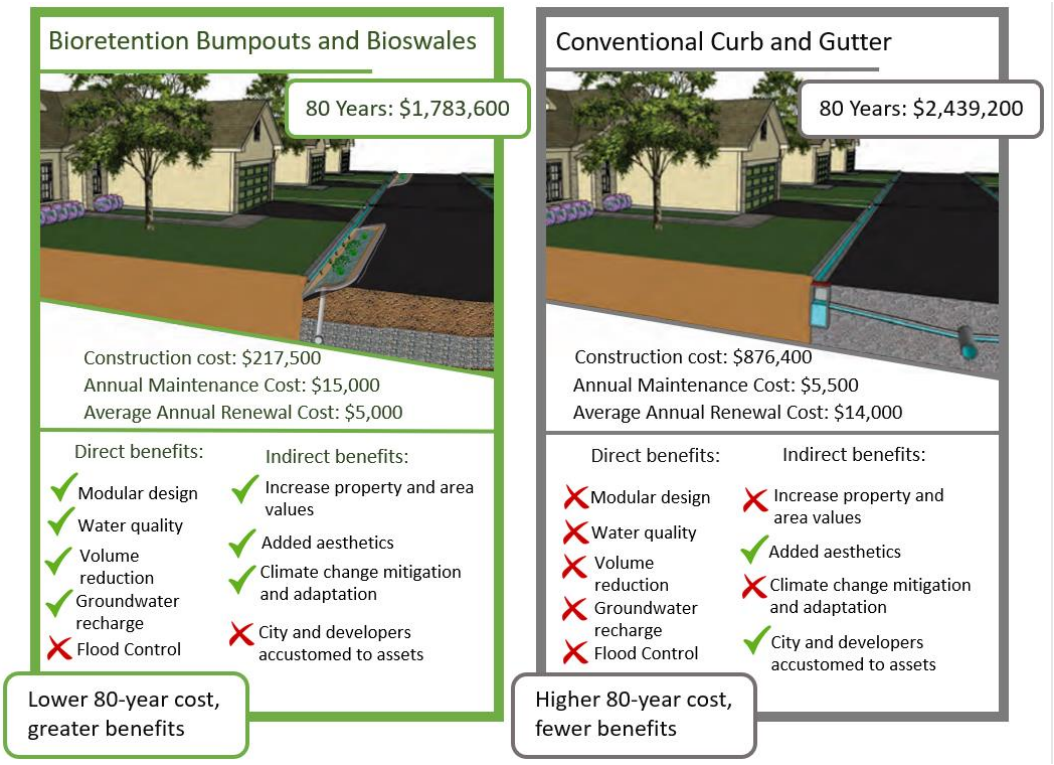

Figure 4: Breakdown of key costs and benefits of GI and conventional infrastructure scenarios for the case study of a proposed rezoning of 70 lots to RU7 in Kelowna's Health District.

[8] Credit Valley Conservation. (2020). *Grey to Green Road Retrofits: Optimizing Your Infrastructure Assets Through Low Impact Development.* Retrieved from: https://cvc.ca/wp-content/uploads/2015/01/Grey-to-Green-ROW-Road-Right-Of-Way.pdf

[9] Credit Valley Conservation. (2020). *Grey to Green Road Retrofits: Optimizing Your Infrastructure Assets Through Low Impact Development.* Retrieved from: https://cvc.ca/wp-content/uploads/2015/01/Grey-to-Green-ROW-Road-Right-Of-Way.pdf

GI Approach Options

There are several approaches a local government can employ to expand green infrastructure within the community: regulations, education and awareness or incentives. Staff are looking at an approach with two phases. The first phase looks at options for expanding off-site GI within the City ROW as outlined in Table 1. As on-site GI options were not reviewed during this project, Phase 2 seeks to research options to encourage and expand on-site GI as outlined in Table 2.

Phase 1: Expanding GI in the ROW

Program	Description
Updating Regulations – can reduce costs and create policy change within established processes	

Bylaw 7900: Subdivision and Servicing
Multiple areas of the bylaw are in the process of being updated
	• Investigate options to integrate:
	  ○ Rainwater management requirements for development (e.g. require a % of on-site infiltration)
	  ○ GI stormwater policy and design manuals/cross sections

Bylaw 10515: Kelowna Development Cost Charges Bylaw **to be updated as part of the 2040 OCP and Servicing Plan**	• Investigate incorporating a stormwater DCC that could be utilized for GI initiatives where appropriate.
Education / Awareness – can increase public and stakeholder's knowledge and awareness of GI	
Communications strategy highlighting flagship projects	• Investigate potential GI projects that can be implemented at high visibility sites to demonstrate the City's commitment to climate initiatives. • Evaluate the costs and performance of the project. • Pair projects with educational signage and materials to demonstrate benefits and potential cost savings. ***Note:*** Projects could incur high capital and operating costs and should only be pursued with the appropriate site selection and budget allocation

Phase 2: Expanding Onsite GI

As on-site GI was out of scope for this project, it is recommended that the following actions be explored at a future date to expand on-site GI.

Program	Description
Updating Regulations – can reduce costs and create policy change within established processes	
Bylaw 8000: Zoning On-site	• Investigate opportunities to update landscaping standards to incorporate green infrastructure concepts (e.g. design landscaping to encourage storm water infiltration, expand tree canopy to reduce heat island effect, etc.)
Incentives – can be an effective means to achieve greater GI implementation in areas outside the City's regulatory scope.	

Incentives	• Investigate incentive programs, as used in several other communities such as Gibsons, Burnaby and Thunder Bay, to encourage the use of GI by developers and property owners. Options include:
	  ○ tax exemptions
	  ○ density bonuses
	  ○ rebates

Next Steps:
The work completed by the Climate Adaptation Intern has sparked interest and discussion amongst multiple City departments. An ad-hoc internal stakeholder group has been assembled to continue the conversation and examine opportunities for the advancement of green infrastructure.

The Subdivision, Development and Servicing Bylaw (Bylaw 7900), Zoning Bylaw (Bylaw 8000) and Kelowna Development Cost Charges Bylaw (Bylaw 10515) are all either in the process of being updated or will be updated over the course of 2021. This provides an opportunity to integrate green infrastructure policy and design within these updates. Consultation with stakeholders and the public will be part of the update process, prior to Council's consideration of the bylaw amendments.

When the City implements new GI projects, communication materials can be developed to educate the public and stakeholders on the costing, potential savings compared to conventional infrastructure and the direct and indirect benefits the GI provides.

Conclusion:
Green infrastructure presents another "*tool in the toolbox*" to address climate change, as it can not only mitigate the risks and costs associated with severe weather, but it can sequester carbon reducing GHG emissions. To date, GI developments have often been considered as "add-ons" to conventional infrastructure rather than incorporating it at the time of development, resulting in missed opportunities. However, placing GI alternatives on par with conventional infrastructure allows for cost-effective opportunities to be considered and acted upon. With increased urbanization and densification, as signaled in the draft 2040 OCP, the myriad of environmental, social, and economic benefits GI delivers will be of increasing importance to support more livable communities.

Internal Circulation:
Development Engineering
Infrastructure Engineering
Infrastructure Operations
Public Works
Integrated Transportation
Utility Planning

Considerations applicable to this report:

Existing Policy:

OCP Policy 6.2.1 **GHG Reduction Targets and Actions**. The City of Kelowna will, in partnership with senior governments; local residents and businesses; NGOs; external agencies; and utility providers, work towards reducing absolute community greenhouse gas emissions by:

- 4% below 2007 levels by 2023
- 25% below 2007 levels by 2033
- 80% below 2007 levels by 2050

OCP Policy 7.1.1 **Life Cycle Analysis.** Complete a life cycle analysis of infrastructure to assess the capital and operating costs of alternative investment options for a given project. Assessment of need, supply and demand strategies should be considered simultaneously.

OCP Policy 7.2.1 **Integrated Design Process.** Ensure all infrastructure projects are considered for an integrated design process to ensure achievement of multiple objectives.

OCP Policy 7.13.1 **Run-off Volumes.** Manage runoff volumes generated by urban development to minimize changes in water flow and impacts to watershed health.

OCP Policy 7.13.2 **Re-use of Stormwater.** Encourage the use of stormwater as a resource not to be wasted but captured and re-used for irrigation and recharging acquirers, where capture and re-use would not negatively impact downslope properties.

OCP Policy 7.13.3. **Urban Run-off Impacts.** Require the mitigation of urban runoff impacts through the effective use of stormwater detention and treatment facilities prior to discharging to receiving waters.

GI supports three of the draft 2040 OCP's ten pillars:

Protect & Restore Our Environment

Take Action on Climate

Focus Investment in Urban Centres

Financial/Budgetary Considerations:

The City received a $12,000 grant from the Pacific Institute for Climate Solutions to support the intern working on this project. Existing budgets supplemented the remainder of the salary costs.

Budgetary implications will be brought forward for Council's consideration as each phase is implemented. It is important to evaluate GI on a life cycle basis and fund accordingly. Capital costs for construction and renewal are often lower than conventional infrastructure, however maintenance costs, which are funded from separate budgets, are often higher.

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